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ABSTRACT

Final evaluation of a 3-year project to use microcomputers to improve the reading and language skills of Limited English Proficient (LEP) Native American students revealed that there was significant growth evidenced in over 75% of the reading subscale groupings as measured by the Comprehensive Tests of Basic Skills (*CTBS). Subjects were 114 Lakota (Sioux) children (grades 3 through 6) who were identified as LEP and attended four Rapid City (South Dakota) elementary schools. Pre/post testing on five CTBS subscale areas (word attack, vocabulary, comprehension, composite, and spelling) showed significant improvement in all areas measured for students in first, fifth, and sixth grades. Results for fourth grade students showed significant improvement only in the vocabulary and composite reading subscales. Overall comparison at the end of the project's second year showed mean Normal Curve Equivalents ranging from a low of 7.21 to a high of 9.69. Analysis of third year scores indicated mean Normal Curve Equivalent growth ranged from a low of 4.79 to a high of 6.67 overall in the areas of vocabulary, comprehension, and in the composite score. (NEC)

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Reading, Computer Assisted Instruction and Native American Students

A Paper Presented at the
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RC 015655

This paper was developed from the final evaluation of the Years II and III (1983-84 and 1984-85) phases of the program "Computer Assisted Instruction for Bilingual/Bicultural Students" funded by the Office of Bilingual Education and Minority Language Affairs (OBEMLA), an office of the U. S. Department of Education. The grant is administered through the Office of Bilingual/Bicultural Education, an agency of the Rapid City Area School District 51-4.

General Overview

The ultimate goal of the three-year project was to improve the reading and language skills of an identified group of Limited English Proficient (LEP) Native American students.

Lakota (Sioux Indian) children constitute 10% of the Rapid City school population. The project was implemented in four elementary schools which contained the highest numbers of Lakota children. Indian children who were identified as LEP (<50 percentile) were chosen as participants.

The unique characteristic of the project was the focus upon the application of microcomputers and microcomputer software in realizing the overall project

goals.

Since the use of such a technologically innovative approach was so new, very little research had been evidenced that provided process models and/or assistance in this area. Hence, the project was plowing new ground in the areas of curriculum development and pedagogy and had implications for baseline research, as well as the fulfillment of the immediate educational goal. The actual purpose of the project was:

1. To develop and incorporate into purchased educational programs instructionally appropriate Lakota cultural and English language arts and reading material.

2. To develop pedagogically appropriate programmed materials for use with microcomputers.

3. To train instructional staff in the methods of CAI technology and relevant bilingual education methodology.

As stated above, the project was focused upon the Lakota children in four target schools. In these schools, 79% of the Lakota students (grades 3-6) were found to have Limited English Proficiency. These students were chosen using a combination of methods including: (a) standardized test scores, (b) assessment scale scores, (c) a review of demographic information

which included family income, and (d) teacher/principal input.

Objectives

The grant proposal delineated the objectives according to those which were to be achieved upon the completion of the three-year project and those which were to be achieved upon the completion of the first year of the project (Year I). These objectives were modified in Years II and III to include the following:

1.0 As a result of participation in this program, significant growth ($P \leq .05$) will be evidenced in 75% of the reading subscale groupings as measured by the Comprehensive Test of Basic Skills (CTBS).

2.0 After examining the CAI records in regard to actual student participation with individual software packages, the three best packages will be identified using a regression approach.

3.0 By the end of the third project year 95% of the bilingual education staff will have participated in all training and technical assistance activities.

4.0 By the end of the third project year 95% of the bilingual education instructional staff will have received training in the operation of the desk top

microcomputers and methods for developing new CAI programs. It should be noted that focus of this paper was limited to the evaluation of Objective 1.0.

Methodology

The evaluation of Objective 1.0 as addressed in the evaluation plan was enhanced with other (more specific) elements which called for additional analyses. These included comparisons by school by grade as well as for the grade and project totals. This process was established in the interest determining whether or not any statistically significant gains had occurred.

Model

To address these dimensions, the Norm-Referenced evaluation model (N-RM) was employed. In the N-RM the performance or gains of the treatment group is compared to the performance of the norming sample, i.e., the group from whose performance the test forms were derived. Therefore, the norming sample (national norms) are used as a comparison group against which to compare the growth or gains of the program group.

Since the Comprehensive Test of Basic Skills (CTBS) is a normed test, a process was established to determine whether or not the project participants improved their

achievement status with respect to the norm group from pre- to post- (fall to spring) testing. The expectation (null hypothesis) for achievement in the absence of the program was that students would maintain (or decrease) their achievement status with respect to the national norms from pre- to post-test. That is, if a child was to score at an NCE of 25 using fall norms, he/she would be expected to maintain an NCE score of 25 on the post-test when spring norms were applied to his/her new score. If a project is effective, then we would expect that the same child to score > 25 NCE at the time of the post-test. The pre-test scores were therefore used to generate post-test expected scores (25/25) which were compared with the post-test (obtained) scores using the t test for determining the statistical significance between testing times. Rejection limits were based on a one-tailed probability and therefore if the computed t probability was less than, or equal to .05, the project would have produced statistically significant achievement gains. The Rapid City compensatory education program uses growth of 3 NCEs as being "highly significant".

All normed tests were administered within two weeks of the dates on which the fall and spring norms

were obtained.

The distribution of CTBS reading scores were subjected to the t test for correlated means in the interest of determining statistical significance of the difference. Spelling scores were also analyzed and reported for informational purposes. Since positive growth was predicted, the one-tailed test of significance ($P < .05$) was applied. The results of these analyses were reported by year in the following two sections.

Analysis of CTBS Scores Year II

Grade Three

A summary of the means, mean growth, t values and one-tailed probability levels (P) was presented in Table 1. As can be noted, a large amount of growth was evidenced with average or mean NCE growth ranging from 15.64 NCE's to 17.68. Probability of this happening by chance alone was computed to be actually less than 1 time in 1,000 as reflected by the P figures of .000. This means essentially that a good deal of highly significant change was evidenced in the scores of these 22 third graders. Growth in spelling scores was also significant.

Table 1

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 3

N=22

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Word Attack	35.95	51.59	15.64	4.64	.000
Vocabulary	32.14	49.82	17.68	5.23	.000
Comprehension	31.14	46.91	15.77	4.44	.000
Composite	32.68	50.18	17.50	6.83	.000
Spelling	35.68	46.95	11.27	4.13	.000

Grade Four

Growth in grade four did not approach the magnitude of difference evidenced in the other three grades. Table 2 was used to report the t test comparisons for this grade level. It should be noted that significant growth was revealed in the comparison of fall (pre-test) and spring (post-test) means for the subscales Vocabulary ($t = 4.07$, $P < .000$) and Composite Reading ($t = 1.83$, $P < .039$). It was interesting to note that the students actually regressed in the area of Comprehension where the spring mean (42.43) was actually smaller than the fall mean (43.23).

Grade Five

Table 3 was used to summarize the results for grade five. As can be noted, all three of the reading subscale scores registered significant growth ($P < .05$) with the greatest difference being manifested in the Composite Reading scores ($t = 3.41$, $P < .001$). Growth in spelling scores ($t = 3.08$, $P < .003$) was also significant.

Grade Six

A summary of the t test comparisons for grade six was presented in Table 4. Again, all of the reading

Table 2

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 4

N=30

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Vocabulary	39.07	47.80	8.73	4.07	.000
Comprehension	43.23	42.43	-.80	-.36	.724
Composite	41.13	44.37	3.23	1.83	.039
Spelling	43.20	46.20	3.00	1.32	.098

Table 3

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 5

N=26

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Vocabulary	32.38	40.88	8.50	2.98	.003
Comprehension	38.35	43.58	5.23	2.29	.015
Composite	35.58	42.73	7.15	3.41	.001
Spelling	35.35	43.46	8.12	3.08	.003

Table 4

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 6

N=30

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Vocabulary	38.43	44.27	5.83	3.19	.002
Comprehension	34.23	44.90	10.67	4.89	.000
Composite	35.50	45.00	9.50	5.50	.000
Spelling	41.30	48.50	7.47	2.69	.006

subscale score comparisons generated t values which surpassed the criterion level of $P < .05$, with the greatest change being evidenced in the subscales of Comprehension ($t = 4.89$) and Composite Reading ($t = 5.50$). Growth in spelling was also significant.

Comment

Objective 1.0 established a criterion level of significant growth ($P < .05$) in 75% of the reading subscale groupings. A total of 13 by subscale by grade comparisons were conducted and all but two (2) of them (see Table 2) revealed significant differences of positive growth. This amounts to 84.6% of the groupings and exceeds the criterion as established in the objective.

Overall Comparison

Table 5 was used to summarize the comparisons for the total group ($N = 108$). Since this overall comparison included all of the data used in the previous by-grade comparisons it was to be expected that the similar results would be realized. As can be noted, overall mean NCE growth ranged from a low of 7.21 to a high of 9.69 overall. The reader will recall that the subscale Word Attack which manifested a growth of 15.64

Table 5

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by all Grades

N=108

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Word Attack*	35.95	51.59	15.64	4.64	.000
Vocabulary	35.87	45.56	9.69	7.48	.000
Comprehension	37.09	44.31	7.21	5.26	.000
Composite	36.51	45.33	8.82	8.05	.000
Spelling	39.18	46.33	7.16	5.44	.000

*Grade Three Only (N=22)

NCE's was limited to the scores of the 22 third graders. All of the reading scores comparisons revealed probability levels of .000, and overall growth in spelling was also significant.

Analysis of CTBS Scores Year III

Grade Three

A summary of the means, mean growth, t values and one-tailed probability levels (P) was presented in Table 6. As can be noted, a large amount of growth was evidenced with average or mean NCE growth ranging from 6.10 NCE's to 16.75. Probability of this happening by chance alone was computed to be actually less than 1 time in 1,000 as reflected by the P figures of .000. This means essentially that a good deal of highly significant change was evidenced in the scores of these 29 third graders. Growth in spelling scores was also significant.

Grade Four

As can be noted in Table 7, significant positive growth was evidenced in all three of the reading subscale scores with t values ranging from 1.90 to 4.35. Growth in the area of spelling ($t = 1.17$, $P = .126$) although positive, did not meet the criterion of

Table 6

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 3

N=29

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Word Attack	35.97	52.72	16.75	8.46	.000
Vocabulary	38.45	45.79	7.34	4.76	.000
Comprehension	33.76	39.86	6.10	3.16	.002
Composite	35.38	46.03	10.66	7.47	.000
Spelling	40.10	48.62	8.52	2.96	.003

Table 7

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 4

N=30

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Vocabulary	37.27	47.17	9.90	4.35	.000
Comprehension	35.80	40.73	4.93	1.90	.034
Composite	35.96	43.23	7.27	3.14	.002
Spelling	42.73	47.33	4.60	1.17	.126

< .05 probability.

Grade Five

Table 8 was used to summarize the results for grade 5. As can be noted, all three of the reading subscale scores registered significant growth ($P < .05$) with the greatest difference being manifested in the Composite Reading scores ($t = 3.59$, $P < .001$). Growth in spelling scores ($t = 1.75$, $P < .050$) was also significant.

Grade Six

A summary of the means t values and one-tailed probability levels for grade six was presented in Table 9. As can be noted, none of the mean scores changed from pre- to post-testing periods.

Comment

Objective 1.0 established a criterion level of significant growth ($P < .05$) in 75% of the reading subscale groupings. A total of 13 by subscale by grade comparisons were conducted and all but three (3) of them (see Table 9) revealed significant differences and positive growth. This amounts to 76.9 of the groupings and exceeds the criterion as established in the

Table 8

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 5

N=32

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Vocabulary	41.66	49.28	7.62	3.26	.002
Comprehension	35.06	42.59	7.53	2.97	.003
Composite	36.84	44.97	8.13	3.59	.001
Spelling	39.71	44.94	5.22	1.75	.050

Table 9

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by Grade 6

N=23

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Vocabulary	40.17	40.48	0.30	0.20	.421
Comprehension	35.96	35.13	-0.83	-0.34	.371
Composite	37.26	37.22	-0.04	-0.03	.487
Spelling	36.60	36.30	-0.30	-0.10	.462

objective. It was interesting to note that all of non-significant elements were found in grade six (6).

Overall Comparison

Table 10 was used to summarize the comparisons for the total group (N = 114). Since this overall comparison includes all of the data used in the previous by-grade comparisons it was to be expected that the similar results would be realized. As can be noted, overall mean NCE growth ranged from a low of 4.79 to a high of 6.67 overall in the areas of Vocabulary, Comprehension and in the Composite score. The reader will recall that the subscale Word Attack which manifested a growth of 16.75 NCE's was limited to the scores of the 29 third graders. All of the reading scores comparisons revealed probability levels of .000, and overall growth in spelling (P = .002) was also significant.

Table 10

Summary of Means, Mean Growth, t Values, and One-Tailed Probability Levels by Subscale by all Grades

N=114

Subscale	Fall NCE Means	Spring NCE Means	Mean Growth	t	P
Word Attack*	35.97	52.72	16.75	8.46	.000
Vocabulary	39.39	46.06	6.67	6.33	.000
Comprehension	35.11	39.90	4.79	3.92	.000
Composite	36.32	43.22	6.55	6.55	.000
Spelling	39.98	44.76	4.78	2.90	.002

*Grade Three Only (N=29)